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ITEM OF INTEREST

Prepared by

790212

Science and Technology Section
Air Information Division

SUBJECT: New Soviet Heat-Resistant Steel

SOURCE: Vorob'yev, Yu. K., V. M. Doronin, M. M. Klyuyev, V. V. Topilin, N. A. Shiryayev, Ye. V. Voynovskiy, B. I. Medovar, Yu. V. Latash, and B. I. Maksimovich. Effect of electroslag remelting on the quality of ЭИ-847 chromium-nickel-molybdenum steel. Avtomaticheskaya svarka, no. 1, Jan 1961, 52-56. TK4660.A1A42 1961. (S/125/61/000/001)

The article deals primarily with the effect of electroslag remelting [Hopkins process] on the content of nonmetallic inclusions and "hot ductility" of ЭИ-847 steel. This steel contains 0.10-0.15% carbon, 14-17% chromium, 14-16% nickel, 2.5-3.5% molybdenum, 0.45-0.85% columbium, 0.8% (max) silicon, 0.8% (max) manganese, 0.02% (max) sulfur, and 0.03% (max) phosphorus. Its structure consists of austenite, $Cr_{23}C_6$ chromium carbide, columbium carbonitrides, and the intermetallic compound $MoFe_2$ (Laves phase).

The austenite in ЭИ-847 steel is distinguished by high stability; the austenitic structure is in no way changed by heat treatment or by cold working with considerable reduction. The fully annealed steel is not susceptible to intergranular corrosion even after prolonged (500-7000 hr) aging at 550-700°C. The 100-hr rupture strength of fully annealed ЭИ-847 is 30 kg/mm^2 at 600°C and 25 kg/mm^2 at 650°C.

The steel is intended primarily for seamless tubing, and consequently low content of nonmetallic inclusions and high hot ductility are of primary importance. Virgin raw materials are used in the melting process. The best combination of properties is obtained when 1) the initial carbon content of the charge is higher than that of the finished steel, 2) melting is done through oxidation (with iron ore), 3) deoxidation is carried out with aluminum powder, and 4) columbium is introduced in the form of the nickel-columbium master alloy or low-silicon ferrocolumbium. However, even when these conditions are fulfilled the steel can still have a rather high content of nonmetallic inclusions. This content can be significantly lowered and hot ductility considerably improved by consumable-electrode vacuum-arc or electroslag remelting. Electroslag remelting produces a metal of almost the same cleanliness and properties as vacuum-arc remelting.

This article reveals for the first time the composition, properties, and field of application of ЭИ-847 steel. According to the ЭИ-number the steel was developed about 1956. It was probably developed as a variant of the 13-16 type steels, since previous variants presented serious technological difficulties in adaptation as materials for seamless tubing.